MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2018/2019**

## PMT0204 – FUNDAMENTAL MATHEMATICS II

( All sections / Groups )

15 MARCH 2019
9.00 a.m. – 11.00 a.m.
( 2 Hours )

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**INSTRUCTIONS TO STUDENTS**

1. This Question paper consists of **6 pages** including cover page and mathematical formulas with **4 Questions** only.
2. Answer all **FOUR (4)** questions
3. Write all your answers in the answer booklet provided.
4. Only NON-PROGRAMMABLE calculators are allowed.

**Question 1 (25 Marks)**

a) Given $A = \begin{bmatrix} -2 & 2 & 4 \\ 5 & x+y & 0 \\ 1 & 8 & 5 \end{bmatrix}, B = \begin{bmatrix} -3 & x-y & 5 \\ 0 & 12 & 1 \\ -4 & 3 & 1 \end{bmatrix}$. Find

i. $x$ and $y$ if $3A = B$. **(6 marks)**

ii. $A + B$ **(3 marks)**

iii. $A.B$ **(5 marks)**

b) Solve the following system of equations by using Cramer's rule.

$$2x + 3y + z = 5$$
$$2x - y + z = 7$$
$$3x + 2y + 2z = 9$$

**(11 marks)**

**Question 2 (25 Marks)**

a) Use the given identity to find the remaining trigonometric functions of the acute angle $\theta$.

$$\cos\theta = \frac{\sqrt{2}}{2}$$

**(6 marks)**

b) Find the amplitude, period and phase shift. Then, graph the function with the key points.

$$y = 2\cos\left(3x + \frac{\pi}{2}\right) - 1$$

**(8 marks)**

c) Solve the equation on the interval $0 \leq \theta \leq 2\pi$.

$$sin^2\theta - cos^2\theta = 0$$

**(6 marks)**

d) Find the area of the triangle with sides $a = 4.5, b = 3.2$ and $c = 6.4$. **(5 marks)**

**Continued...**

**Question 3 (25 Marks)**

a) Find the derivative of the following function:

i. $f(x) = x^{\frac{1}{3}} - 2x^{-2} + 3x$ **(2 marks)**

ii. $f(x) = (x^2 + 2)(x^2 - 1)$ **(6 marks)**

iii. $f(x) = (2x^3 + x^2 - 1)^4$ **(3 marks)**

b) Find third derivative of $f(x) = 3x^3 + 4x^2 - 5$ **(3 marks)**

c) Find the intervals of increasing and decreasing of the function
$f(x) = x^3 - 3x^2 - 9x + 2$

Hence, find the relative maximum and minimum. **(11 marks)**

**Question 4 (25 Marks)**

a) Find the limit, if exists.

i. $\lim_{x \to -3} (x^2 + 2x + 5)$ **(2 marks)**

ii. $\lim_{x \to 2} \frac{x^2 + x - 6}{x - 2}$ **(3 marks)**

iii. $\lim_{x \to \infty} \frac{3x + 2}{x + 1}$ **(4 marks)**

b) Integrate the following:

i. $\int (3x^4 + x^3 + 2x - 10)dx$ **(2 marks)**

ii. $\int \left(\frac{2}{x^3} + 4x^2 - 2\right) dx$ **(3 marks)**

c) Evaluate the integral

$$\int_{-1}^{2} x(x^2 + 1)^{\frac{1}{2}} dx$$ **(7 marks)**

d) Find the area bounded by curve $y = x^2 - 9$ and $x$-axis on the interval $[-3,4]$. **(4 marks)**

**End of Questions.**

**Course: Fundamental Mathematics II**
**Code: PMT0204**

## Matrices

***Inverse of a 2 × 2 matrix***

If $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1}=\frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$, where $ad-bc\neq 0$.

***Determinant of a 3 × 3 matrix***

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1\begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1\begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1\begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

***Cramer's Rule for 3 × 3 matrix***

$a_1x + b_1y + c_1z = d_1$
$a_2x + b_2y + c_2z = d_2$
$a_3x + b_3y + c_3z = d_3$

then $x=\frac{D_x}{D}, y=\frac{D_y}{D}, z=\frac{D_z}{D}$ where

$$D=\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix},\ D_x=\begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix},\ D_y=\begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix},\ D_z=\begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$

## Trigonometry

***Law of Sine***

$$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$$

***Law of Cosine***

$a^2 = b^2 + c^2 - 2bc\cos A$
$b^2 = a^2 + c^2 - 2ac\cos B$
$c^2 = a^2 + b^2 - 2ab\cos C$

***Pythagorean Identity***

$\sin^2\theta + \cos^2\theta = 1$
$\tan^2\theta + 1 = \sec^2\theta$
$1 + \cot^2\theta = \csc^2\theta$

**Continued...**

## Derivatives

$$f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$

## Differentiation Rules

### *General Formulae*

1. $\frac{d}{dx}[f(x)g(x)]=f(x)g'(x)+g(x)f'(x)$
2. $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$
3. $\frac{d}{dx}\left(x^n\right)=nx^{n-1}$
4. $\frac{d}{dx}[f(u)]=\frac{dy}{du}\cdot\frac{du}{dx}$

### *Exponential and Logarithmic Functions*

1. $\frac{d}{dx}\left(e^x\right)=e^x$
2. $\frac{d}{dx}\left(a^x\right)=a^x\ln a$
3. $\frac{d}{dx}(\ln x)=\frac{1}{x}$
4. $\frac{d}{dx}(\log_a x)=\frac{1}{x\ln a}$

### *Trigonometric Functions*

1. $\frac{d}{dx}(\sin x)=\cos x$
2. $\frac{d}{dx}(\cos x)=-\sin x$
3. $\frac{d}{dx}(\tan x)=\sec^2 x$
4. $\frac{d}{dx}(\csc x)=-\csc x\cot x$
5. $\frac{d}{dx}(\sec x)=\sec x\tan x$
6. $\frac{d}{dx}(\cot x)=-\csc^2 x$

## Table of Integrals

1. $\int u\,dv=uv-\int v\,du$
2. $\int u^n\,du=\frac{u^{n+1}}{n+1}+C,\quad n\neq -1$
3. $\int\frac{du}{u}=\ln|u|+C$
4. $\int e^u du=e^u+C$
5. $\int\sin u\,du=-\cos u+C$
6. $\int\cos u\,du=\sin u+C$
7. $\int\sec^2 u\,du=\tan u+C$
8. $\int\csc^2 u\,du=-\cot u+C$
9. $\int\sec u\tan u\,du=\sec u+C$
10. $\int\csc u\cot u\,du=-\csc u+C$

**Continued...**

**Application of Integrals:**

| *Areas Between Curves* | *Volume by Disks* | *Volume by Washer* |
|---|---|---|
| $A = \int_a^b [f(x) - g(x)]dx$ | $V = \int_a^b \pi [R(x)]^2 dx$ | $V = \int_a^b \pi \left( [f(x)]^2 - [g(x)]^2 \right) dx$ |
| $A = \int_c^d [w(y) - v(y)]dy$ | $V = \int_c^d \pi [R(y)]^2 dy$ | $V = \int_c^d \pi \left( [w(y)]^2 - [v(y)]^2 \right) dy$ |

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